

A new Genus and four new Species in the Family Echinasteridae (Echinodermata: Asteroidea)

FRANCIS W. E. ROWE and E. LYNNE ALBERTSON

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A new genus and four new species of echinasterid asteroids are described. The species are recorded from South African, southern and southeastern Australian, Japanese and northwestern North American waters. The genus is characterized by the occurrence of a large, hyaline-tipped recurved spine at the apex of the jaw. The genus otherwise shows a close relationship with *Henricia* Gray (1840).

F. W. E. Rowe and E. L. Albertson, Division of Invertebrate Zoology, Australian Museum, Sydney, Australia, 2000; manuscript received 6 February 1987, accepted for publication 22 July 1987.

INTRODUCTION

During an investigation of the echinoderm fauna of New South Wales, taxonomic problems became apparent in members of the asteroid spinulosid family Echinasteridae. The identity of species of the genus *Henricia* in southern and southeastern Australia and the description of a new species of *Echinaster* from New South Wales, have been reported by us elsewhere (Rowe and Albertson, 1987a, b).

The present taxonomic problem deals with a geographically widespread group of new species which share in common a large recurved hyaline-tipped spine at the apex of the jaw angle. All other features are typically echinasterid. The presence of this apical tooth was identified first amongst southern and southeastern Australian specimens identified in the genus *Henricia* held in the Australian Museum (AM) and Museum of Victoria (MV) collections. During a visit to the United States National Museum (USNM) the senior author found two additional specimens, one from Japanese waters, the other from off Washington State, NW coast of North America. Finally two specimens were included amongst a collection identified as *Henricia abyssalis* from South African waters, on loan from the British Museum (Natural History) (BM(NH)) in London, U.K.

SYSTEMATIC DESCRIPTION

Family ECHINASTERIDAE Verrill (1867)

Genus *Odontohenricia* nov.

Description: An echinasterid sea star with 5 rays (rarely 6); reticulate abactinal skeleton, plates raised centrally forming ridges which bear spinelets; marginal series distinguishable, inferomarginal plates pronounced; papulae present abactinally, marginally and actinally; 2-3 furrow spines in vertical series; large recurved hyaline spine present at apex of each pair of oral plates, the size 3 to 4 times greater than adjacent spines.

Type species: *Odontohenricia endeavourii* n.sp., herein designated.

Etymology: *odontos* = (Greek) tooth, referring to the apical oral spine characterizing this genus.

henricia = named after the genus *Henricia*, in recognition of the otherwise close morphological association of these genera.

Other species included: *O. clarkae* n.sp., *O. fisheri* n.sp., *O. hayashii* n.sp.

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Other species included: *O. clarkae* n.sp., *O. fisheri* n.sp., *O. hayashii* n.sp.

Remarks: *Odontohenricia* differs from all other members of the family by possessing a recurved apical spine. Otherwise the new genus appears to share most features in common with *Henricia* Gray, 1840, including the form of skeleton and arrangement of spines.

Considering the general echinasterid features of these species, we do not believe the possession of this hyaline-tipped apical spine warrants the establishment of a new family. We do, however, consider this discrete group of species should be recognized within its own supra-specific taxon and describe a new genus accordingly. As far as we are aware, the recurved apical spine is a feature shared only with members of the valvatid family Odontasteridae.

Within the Echinasteridae, *Plectaster* Sladen, 1889 is the only genus in which the furrow spines occur in a comb-shaped row along the adradial edge of the adambulacral plate (Fig. 1). We believe this genus does not belong in this family, though we decline herein to reassign it, since it is outside the scope of this paper.

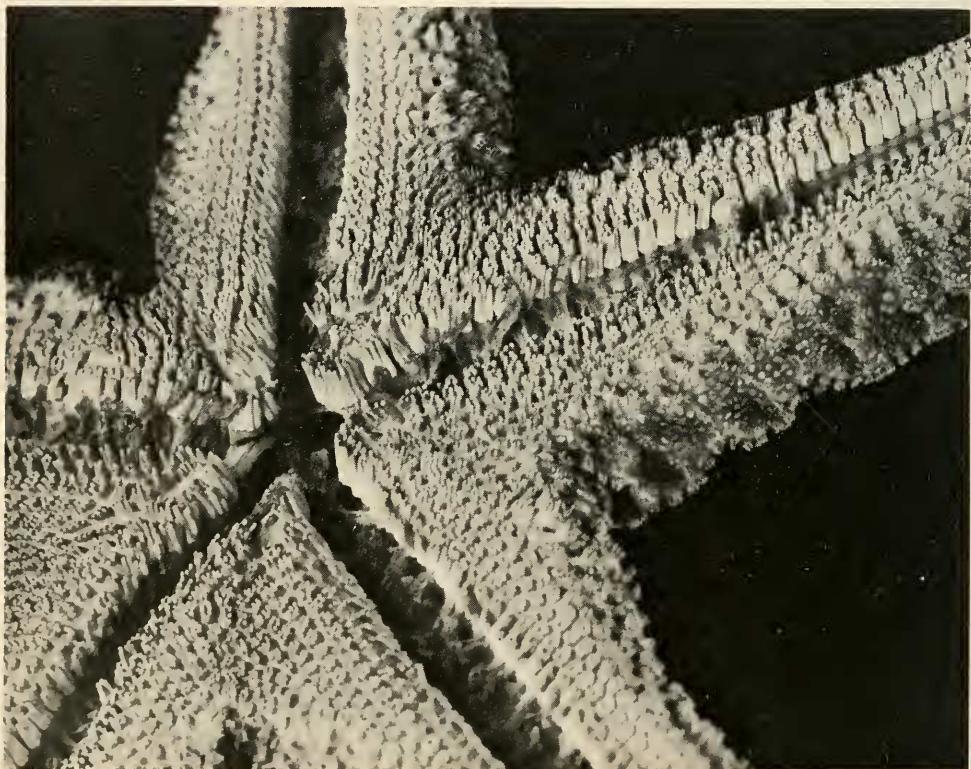


Fig. 1. *Plectaster decanus* (AM J13074): Actinal surface showing the comb-shaped rows of spines along the adradial edge of the adambulacral plates.

Odontohenricia endeavouri n.sp.

Figs 2A-B, 3A-B, 4A-E

Henricia hyadesi, H. L. Clark, 1916: 60 (part); 1946: 148 (part) [non *H. hyadesi* (Perrier, 1891) = *H. obesa* (Sladen, 1889) according to Fisher, 1940: 164].

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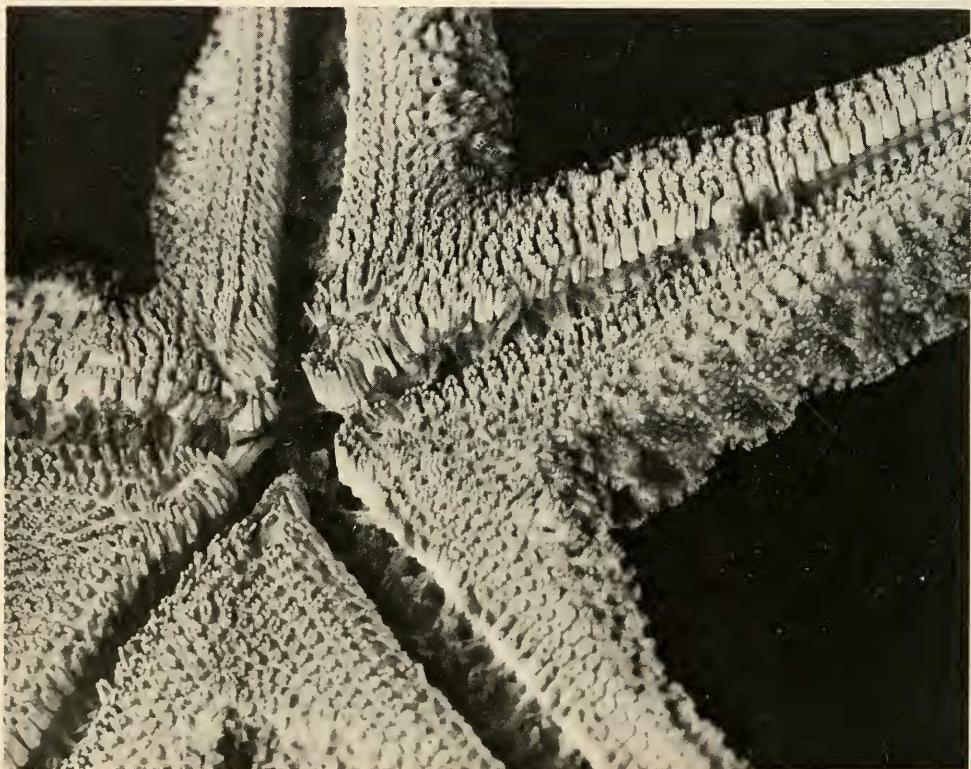


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Diagnosis: Rays 5, rarely 6, $R=31\text{-}83\text{mm}$, $r=5\text{-}14\text{mm}$, $R/r=5\text{-}12$, inflated proximally and tapering; abactinal skeleton closely reticulate, 1-2 rarely 3 papulae per papular area; plates overlapping, irregular, ovoid to stelloid form; plates medially ridged bearing fine spinelets which taper to an acute tip, spinelets in tufts of 3-9, or in 1-3 comb-like irregular rows; marginal plates distinct, ridged medially and bear spinelets, superomarginals and inferomarginals quadrilobed, inferomarginal plates markedly higher than wide, intermarginal plates more or less quadrilobed with small plates between, 1-3 series, actinal plates quadrilobed 1-3 series, marginal spinelets as for abactinal plates; papulae extend to actinal series with 1 papula per area; 2 (3) furrow spines in vertical series, adambulacral plates with a large cylindrical or slightly compressed subambulacral spine on the adradial edge, behind which stand a pair of shorter but similar spines. Smaller serrately tipped subambulacral spines, occur across the remaining surface of the adambulacral plate, (these often appear to be aligned in a double row); large recurved spine at apex of oral angle, 4-5 spines occur along furrow margin of oral plates, 3-4 spines occur on actinal surface of oral plates.

Materials examined: Holotype, AM J8792, off Eden, New South Wales; 1 paratype, AM J7156, Lakes Entrance, Vic.; 1 paratype, AM J5859, Bass Strait west of Babel Island, 128m; 4 paratypes, AM J20080, off Eden, N.S.W.; 1 paratype, AM J3072, Great Australian Bight, 146.3-219.5m; 4 paratypes, MV Acc. No 75-9, 38°44'S, 141°33'E, 18 miles south of Cape Nelson, Vic., 153.6m; 3 paratypes, MV Acc. No 75-9, 38°44'S, 141°33'E, 12.5 miles south of Cape Nelson, Vic., 146.3-155.4m; 1 specimen, AM J12868, 34°21'S, 151°24'E to 34°14'S, 151°28'E, northeast of Wollongong, N.S.W., 402m; 1 specimen, AM E3648, Great Australian Bight, 146-274m; 1 specimen, AM J5857, Bass Strait; 1 specimen, AM J17266, 34°43'S 151°12'E to 34°38'S 151°16'E, N.S.W., 457m; 1 specimen, AM E3772, Great Australian Bight, 274m; 2 specimens AM J20081, 35°02'S 151°06'E to 34°58'S 151°08'E, off Shoalhaven, N.S.W., 439-420m; 2 specimens, AM J20082, 34°28'S, 151°19'E, N.S.W., 412m; 1 specimen, AM J7155, off Eden, N.S.W.; 1 specimen, AM J12871, 35°44'S, 150°37'E, east of Brush Island, N.S.W., 384m; 1 specimen, AM J13202, 38°12'S 149°49'E to 38°11'S 149°53'E, southeast of Gabo Island, Vic., 439m; 1 specimen, AM J7007, off Newcastle, N.S.W.; 1 specimen, AM J20083, 36 miles south of Mt Cann, Vic., 205m; 1 specimen, AM J7052, off Eden, N.S.W.

Distribution: Southeastern Australia, from off Newcastle, New South Wales to Bass Strait and the Great Australian Bight, in depths ranging from 128-457m.

Etymology: Named for the Federal Fisheries Investigation ship 'Endeavour' from which extensive collections of southeastern and southern Australian fauna, including echinoderms, were made.

Description: The holotype has 5 rays, inflated proximally and tapering to a fairly acute tip, $R=40\text{mm}$, $r=7\text{mm}$, $R/r=5.7$. The disc is small. The madreporite is small and ridged, occurring interradially at about $\frac{1}{2}r$.

The abactinal skeleton (Figs 2A, 4A) is stout and closely reticulated, with 1-2, rarely 3 papulae per mesh. The overlapping plates are irregular — ovoid to stellate in shape. Additional small plates and processes occasionally project from the main skeletal plates into the papular region. The plates are raised centrally into low ridges bearing spinelets in tufts of 3-9, or in 2-3 irregular crescentic rows (Fig. 4B). The spinelets are fine, serrated and taper to an acute tip (length: 0.24mm, width: 0.06mm).

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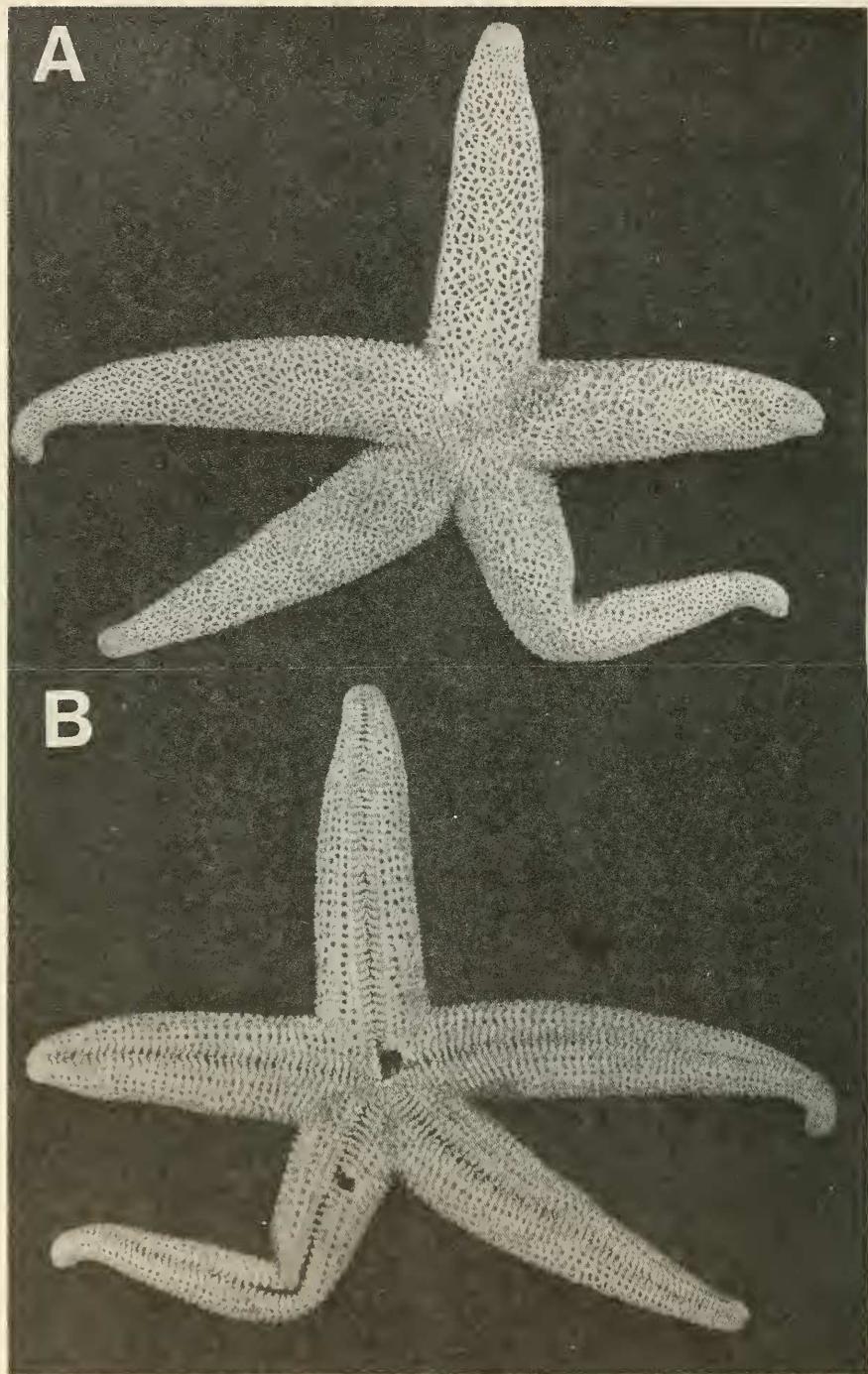


Fig. 2. *Odontohenricia endeavouri* n. gen. et. sp. (holotype; AM J8792): A. abactinal surface; B. actinal surface ($R=40\text{mm}$).

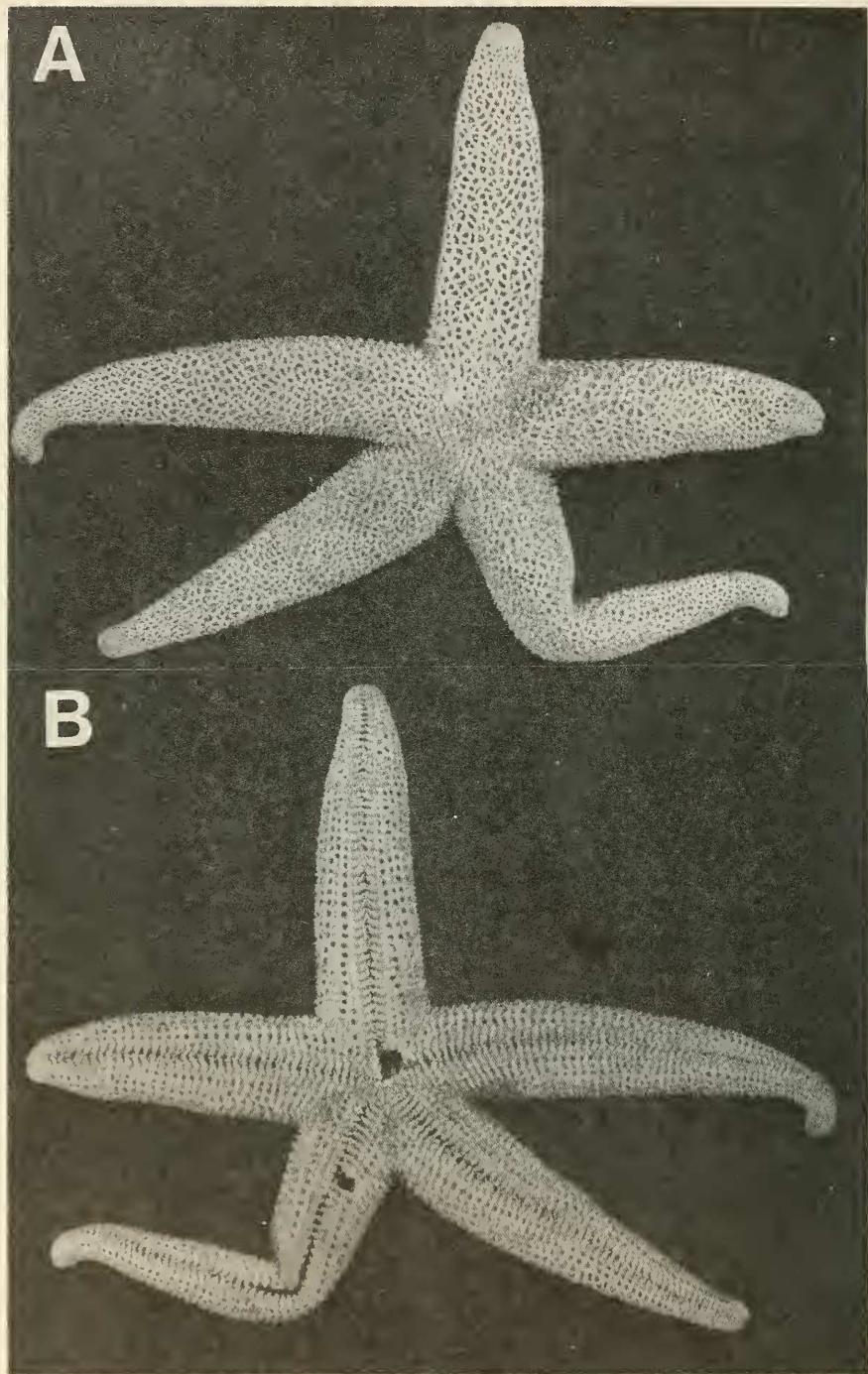


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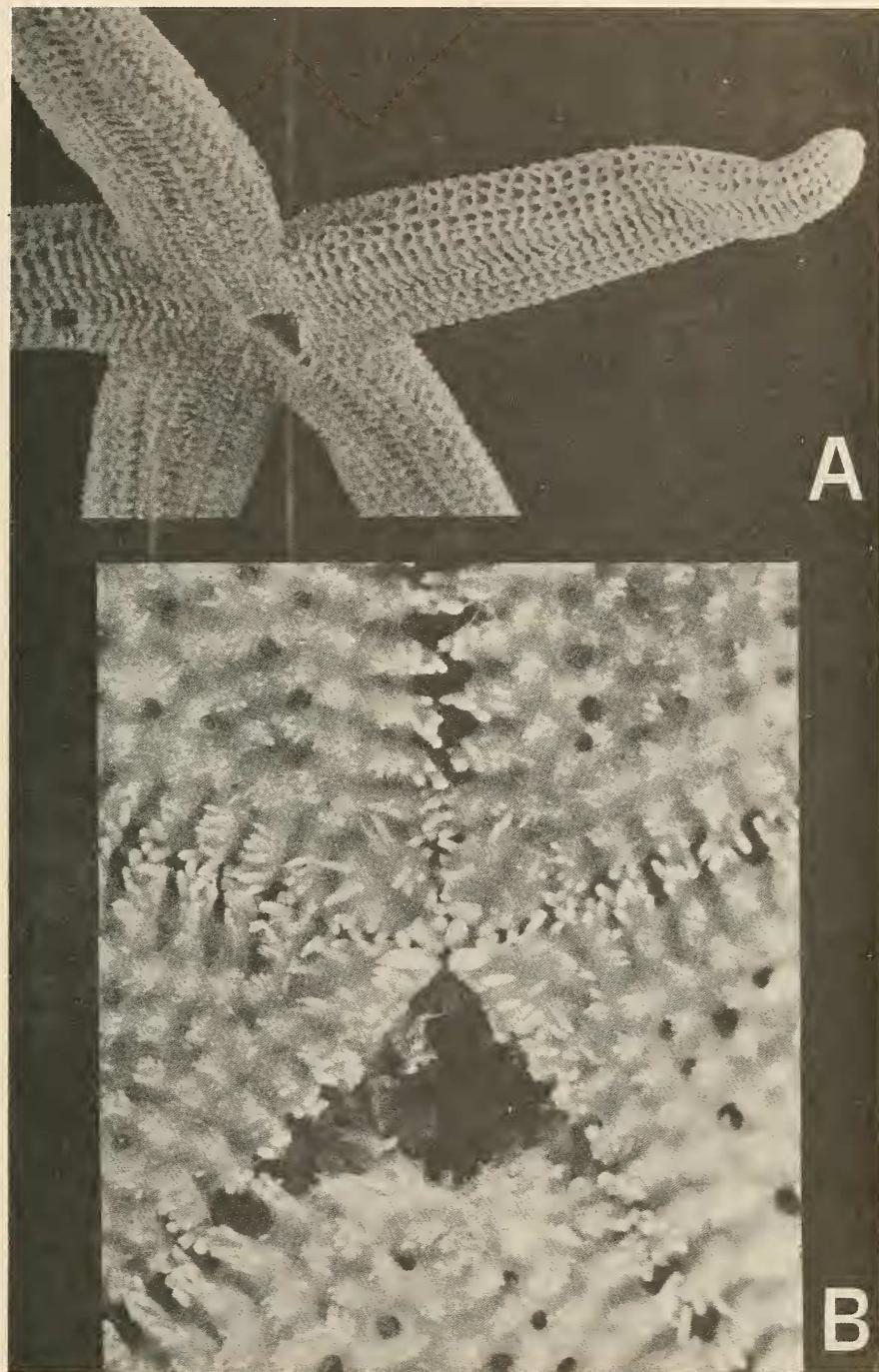


Fig. 3. *Odontohenricia endeavouri* n. gen. et. sp. (holotype; AM J8792); A. lateral view of arm; B. actinal region showing apical oral spines, adambulacral spines and papulae.

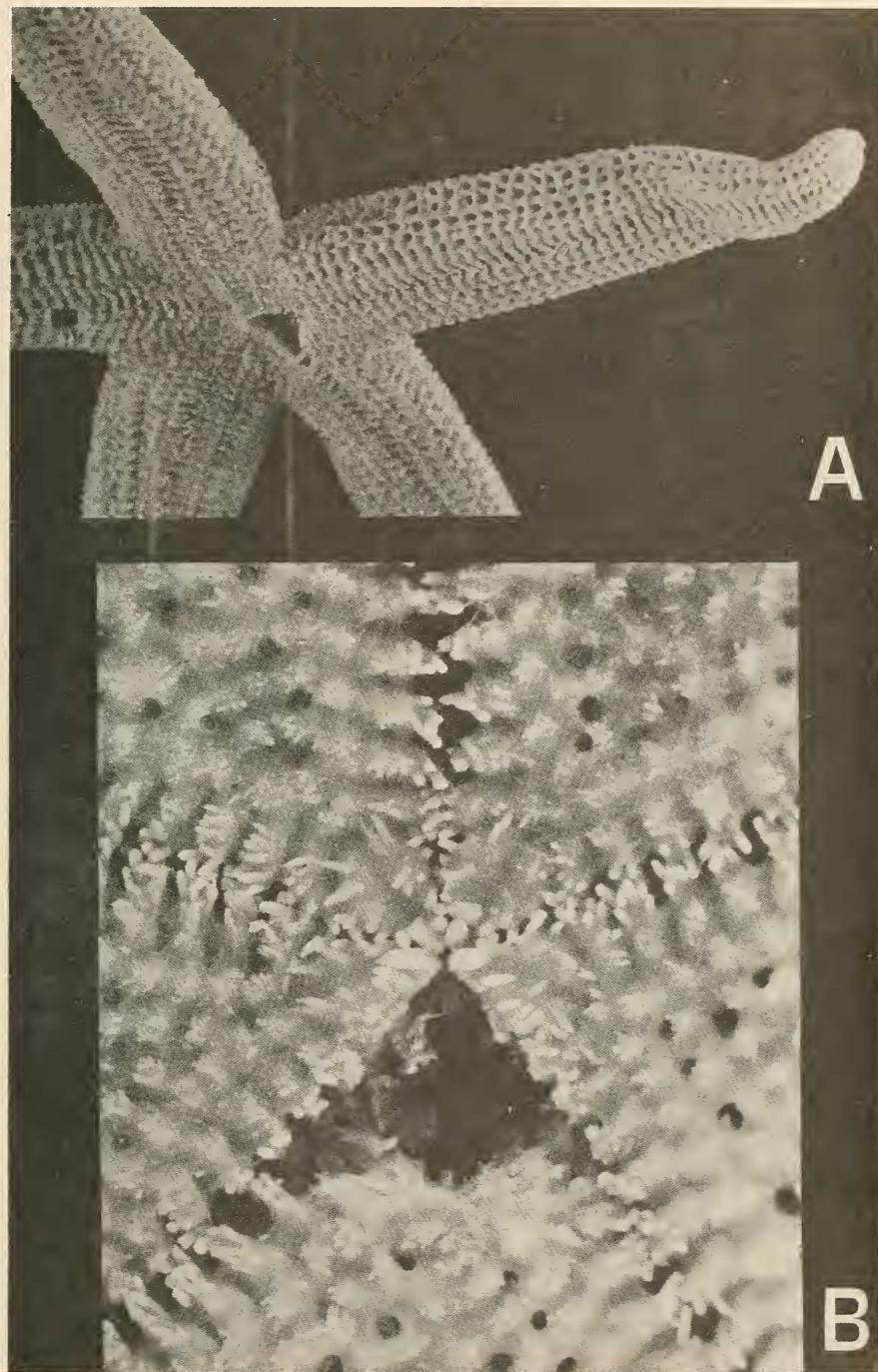


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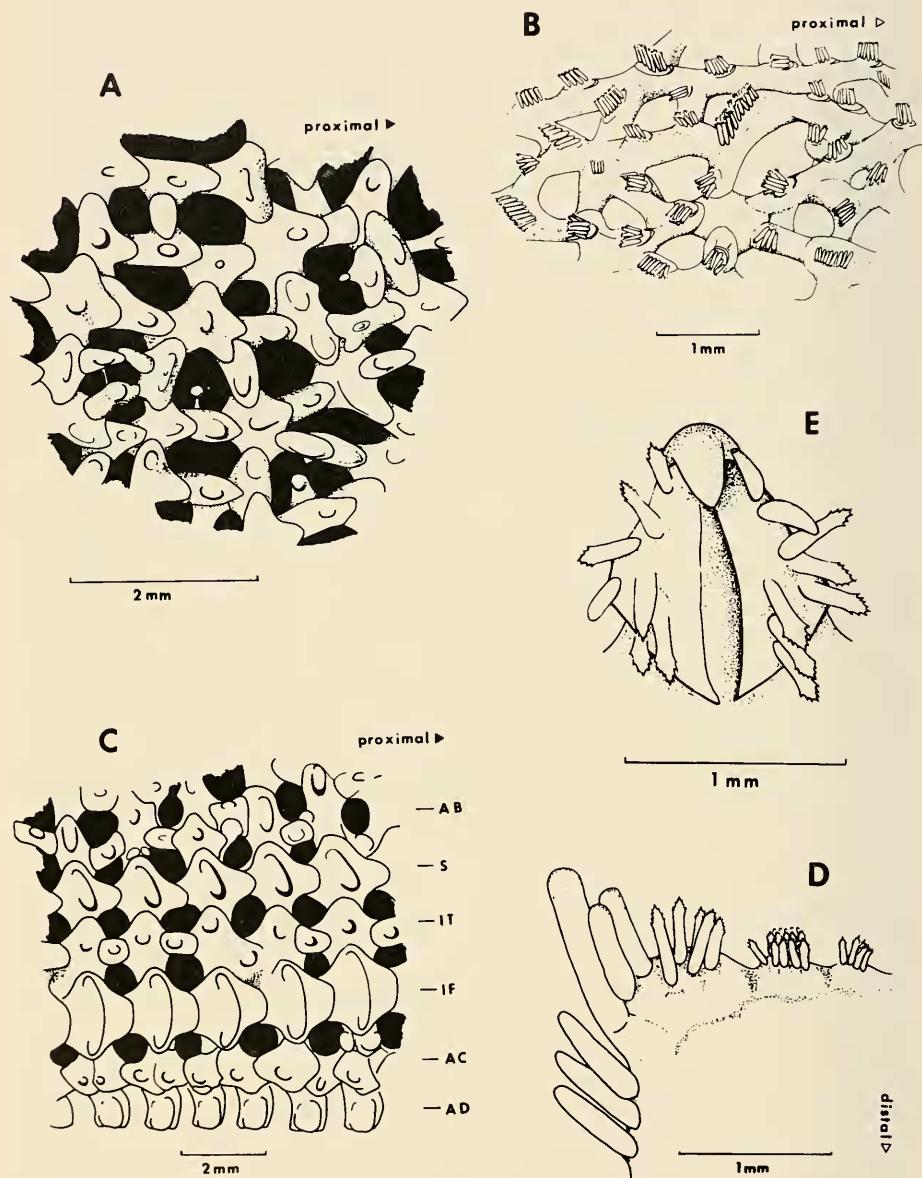


Fig. 4. *Odontohenricia endeavouri* n. gen. et. sp. (holotype; AM J8792): A. denuded abactinal skeleton of arm, (proximal); B. abactinal spinelets of arm (proximal); C. denuded skeleton of arm, lateral view from $\frac{1}{2}R$, distally; AB = abactinal plates, S = superom marginal plates, IT = intermarginal plates, IF = inferom marginal plates, AC = actinal plates, AD = adambulacr al plates; D. profile view of 2nd adambulacr al plate showing alignment of furrow spines and subambulacr al spines and with adjacent actinal plates; E. actinal view of pair of oral plates showing large, apical, recurved oral spine and suboral spines.

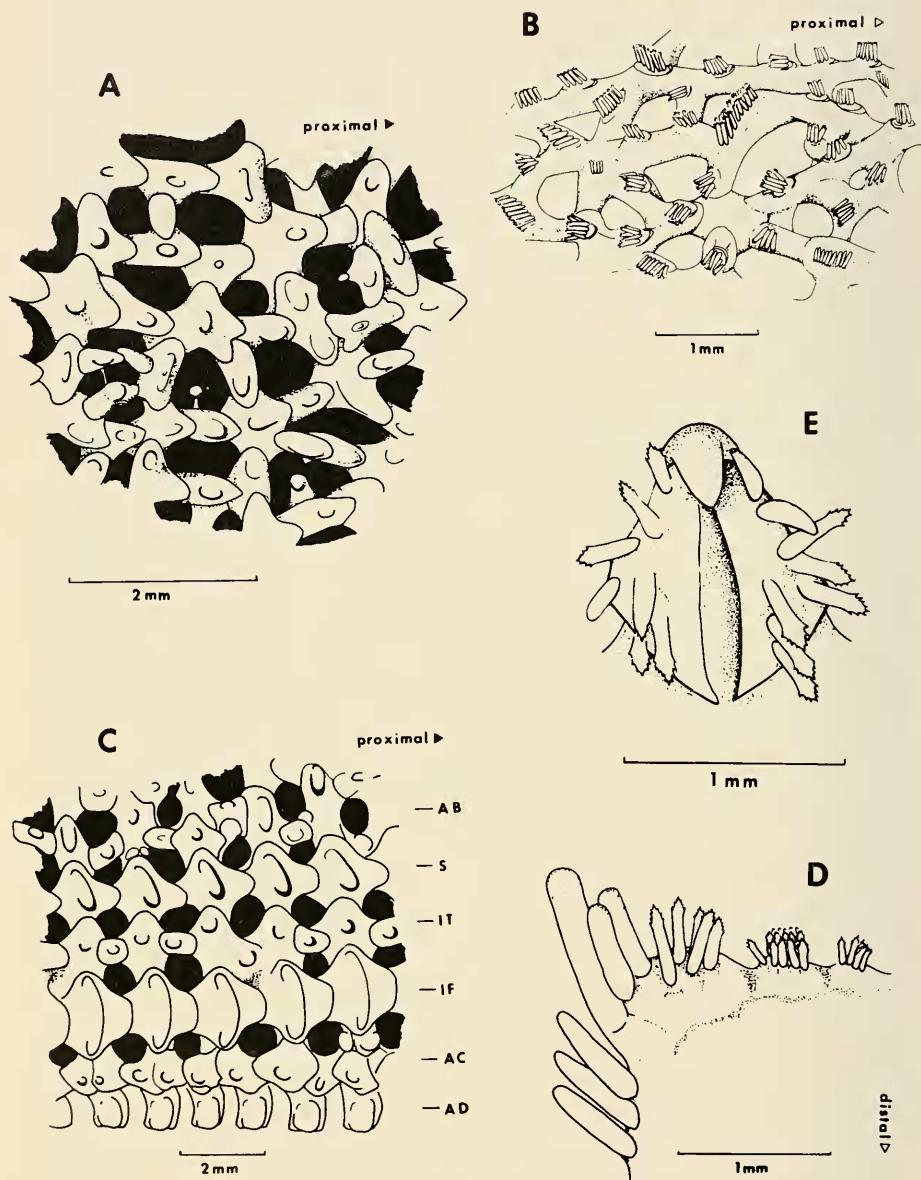


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The marginal plates (Figs 3A, 4C) are distinct due to their size, regular shape and alignment. The superomarginals are quadrilobed, about as long as wide, with a median spinelet bearing ridge oriented obliquely. The inferomarginals are also ridged and quadrilobed, markedly higher than wide, making this series conspicuous.

The intermarginal plates are more or less quadrilobed, bridged with smaller plates. Both the quadrilobed and bridging plates are ridged centrally and bear spinelets. The principal intermarginal series extends $\frac{3}{4}R$, while a second series consists of a few plates only.

Actinal plates occur in two rows, the first extending almost the ray length, the second only $\frac{1}{4}R$. The plates are centrally ridged and bear spinelets. There is one papula present between adjacent plates to the marginal series.

A vertical row of 2-3 tapered blunt furrow spines is present within the furrow. The adambulacral plates (Figs 3B, 4D) bear 2 transverse rows of up to 5 cylindrical subambulacral spines on their actinal surface. The spines decrease in size across the plate. Spines at furrow edge are cylindrical, rounded apically, while those behind are tapered, serrated becoming similar to spinelets on adjacent actinal plates.

Each pair of oral plates is dominated by a large recurved hyaline spine at their common apex, 4(5) dentate spinelets occur on the furrow margin of each plate with 3-4 suboral spines on the actinal surface of each oral plate.

Paratypes: Some variation was found within the 11 designated paratypes. All were 5 rayed $R=30-69mm$, $r=5-12mm$ except one (AM J3072) which is 6 rayed. The number of intermarginal and actinal series varied from 1-3, extending from $\frac{1}{4}-\frac{3}{4}R$, in the first series, a few plates to $\frac{1}{4}R$ in the second, and a few plates sometimes present as a third. Similarly, the first actinal series may extend between $\frac{3}{4}R$ to R , the second from a few plates to $\frac{1}{4}R$, and sometimes a few plates formed a third series.

Other material: Some 15 further specimens have been identified. These fall within the variation we recognize within the type series.

Remarks: *O. endeavouri* differs from other known *Odontohenricia* by the arrangement of the abactinal spinelets, the presence of stellate plates in the abactinal skeleton and the elongated inferomarginal plates.

Odontohenricia clarkae n. sp.

Figs 5A-B, 6A-E

Diagnosis: Rays 5, $R=26-33mm$, $r=4.4-6.6mm$, $R/r=5-6$; rays cylindrical, tapering to a rounded tip; abactinal skeleton reticulate, 2-9 papulae per papular area; plates ridged medially, carrying 6-15 serrated spinelets; marginal plates distinct, with obvious vertical and horizontal alignment of series; plates quadrilobed, with trilobed ridges; inferomarginal plates higher than broad, more elongate than superomarginals, 1-2 intermarginal series; 2-4 actinal series; 1-5 papulae present throughout marginal series, adambulacral plates with 1-2 furrow spines in vertical series, one prominent subambulacral spine on adradial edge of plate with 10-13 subambulacral spines behind in 2 rows; oral plate pair with large apical recurved spine, each plate with 2-3 small spinelets along furrow margin, and an additional 3 suboral spines.

Material examined: Two specimens, holotype and paratype, BM (NH) 1951.5.8.2, $34^{\circ}33'S$ $18^{\circ}20'E$, off the Cape of Good Hope, South Africa, 290m.

The marginal plates (Figs 3A, 4C) are distinct due to their size, regular shape and alignment. The superomarginals are quadrilobed, about as long as wide, with a median spinelet bearing ridge oriented obliquely. The inferomarginals are also ridged and quadrilobed, markedly higher than wide, making this series conspicuous.

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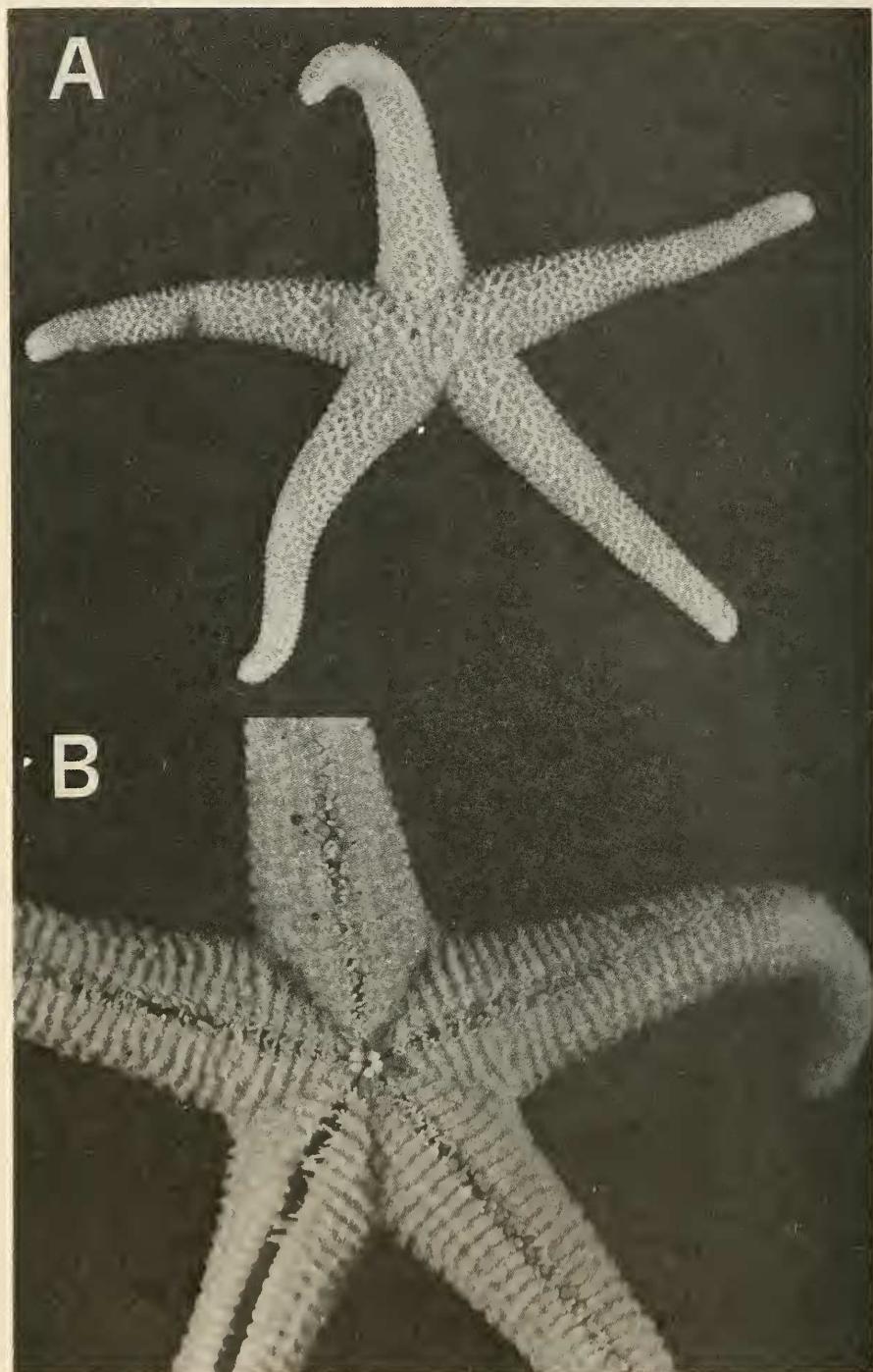


Fig. 5. *Odontohenricia clarkae* n. gen. et. sp. (paratype; BM (NH) 1951. 5.8.2): A. abactinal view; B. actinal surface, showing apical oral spines, abactinal and marginal spinelets ($R=26\text{mm}$).

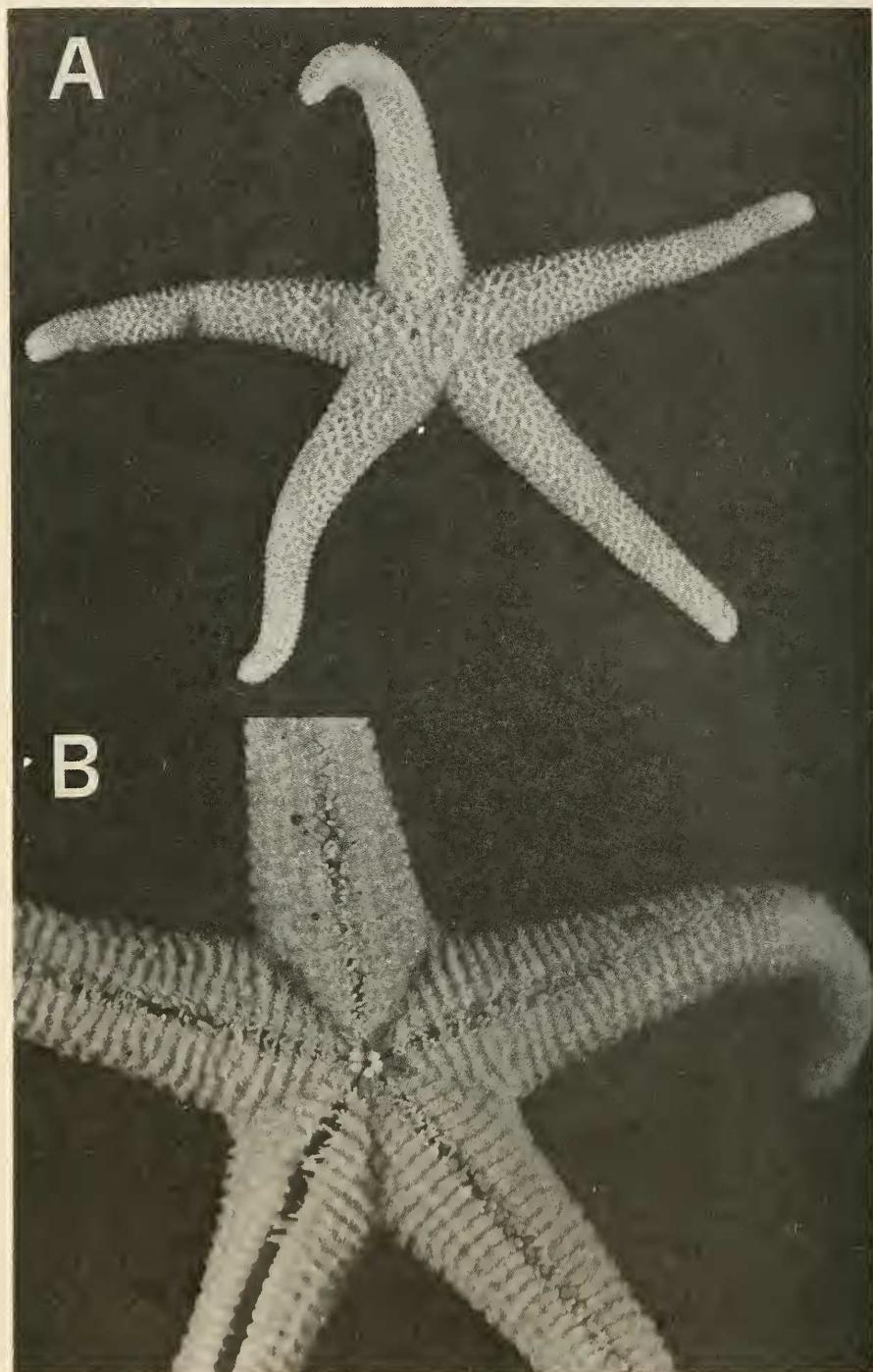


Fig. 5. *Odontohenricia clarkae* n. gen. et. sp. (paratype; BM (NH) 1951. 5.8.2): A. abactinal view; B. actinal surface, showing apical oral spines, abactinal and marginal spinelets ($R=26\text{mm}$).

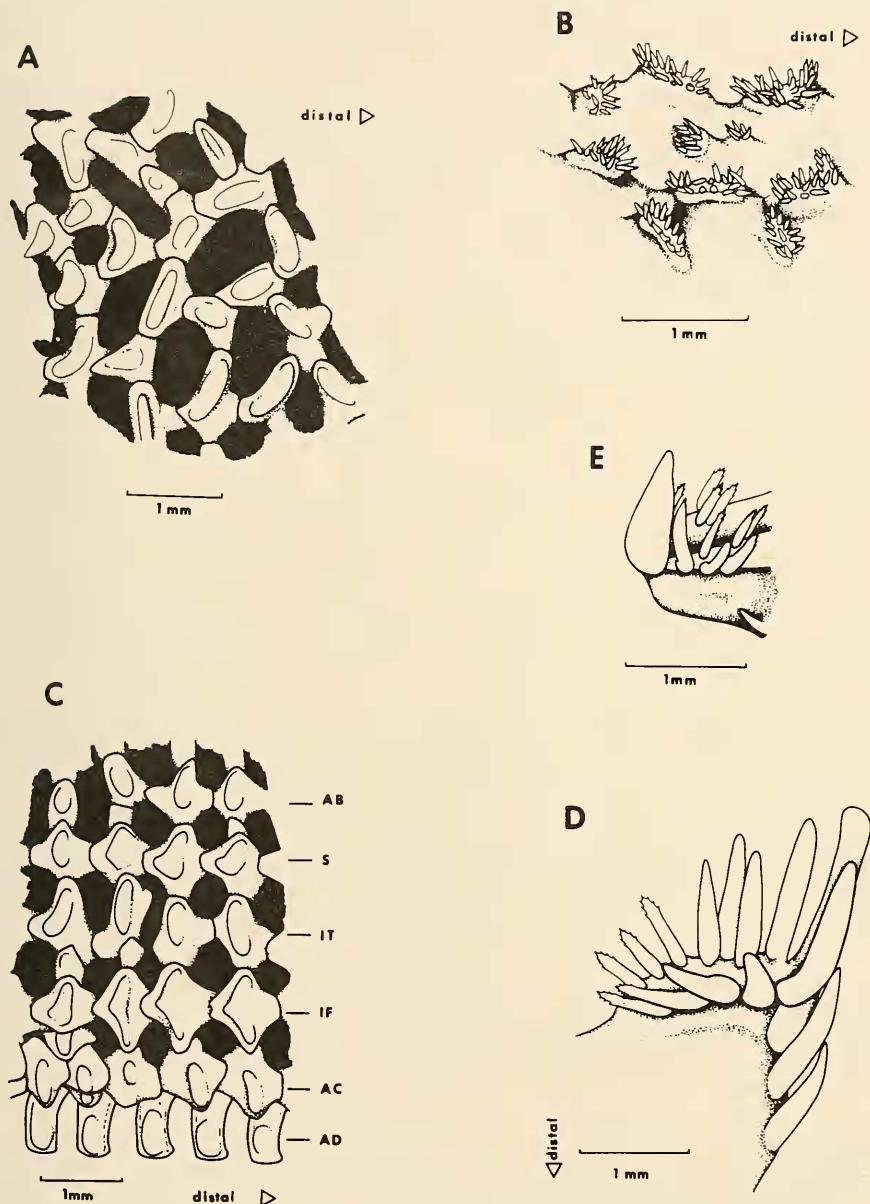


Fig. 6. *Odontohenricia clarkae* n. gen. et sp. (holotype; BM (NH) 1951. 5.8.2): A. denuded abactinal skeleton of arm (proximal); B. abactinal spinelets of arm (proximal); C. denuded skeleton of arm, lateral view (proximal); AB = abactinal plates, S = superom marginal plates, IT = intermarginal plates, IF = inferom marginal plates, AC = actinal plates, AD = adambulacral plates; D. profile view of 5th adambulacral plate with furrow and subambulacral spines; E. oblique-lateral view of pair of oral plates showing large apical oral spine and suboral spines ($R=33\text{mm}$).

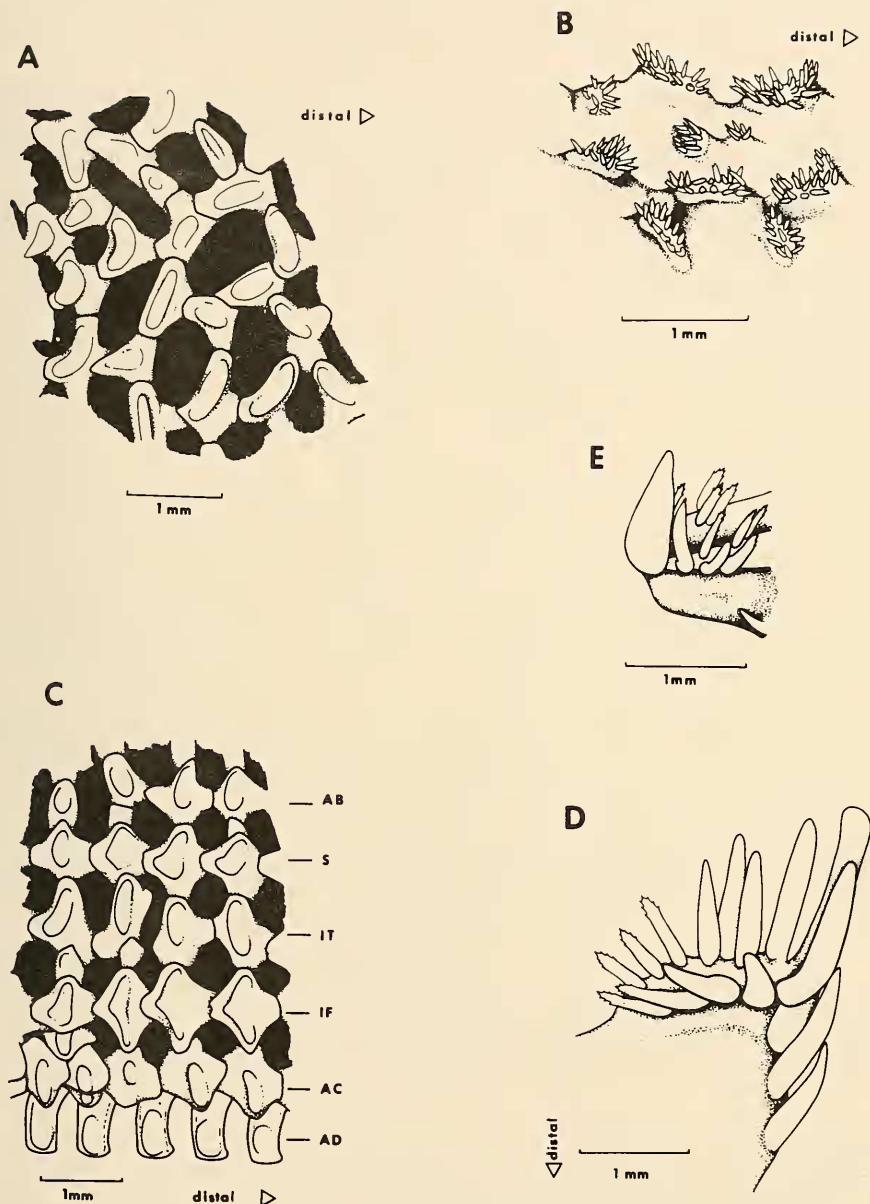


Fig. 6. *Odontohenricia clarkae* n. gen. et sp. (holotype; BM (NH) 1951. 5.8.2): A. denuded abactinal skeleton of arm (proximal); B. abactinal spinelets of arm (proximal); C. denuded skeleton of arm, lateral view (proximal); AB = abactinal plates, S = superom marginal plates, IT = intermarginal plates, IF = inferom marginal plates, AC = actinal plates, AD = adambulacral plates; D. profile view of 5th adambulacral plate with furrow and subambulacral spines; E. oblique-lateral view of pair of oral plates showing large apical oral spine and suboral spines ($R=33\text{mm}$).

Distribution: At present known only from the type locality.

Etymology: Named for Ailsa Clark for her significant contribution to the knowledge of the echinoderm faunas, including that of southern Africa.

Description: The species has 5 rays, cylindrical and tapering to a rounded tip. Holotype $R=33\text{mm}$, $r=6.6\text{mm}$, $R/r=5$; paratype $R=26\text{mm}$, $r=4.4\text{mm}$, $R/r=5.9$. The disc is small. The madreporite occurs interradially at approximately $\frac{1}{3}r$.

The abactinal skeleton (Fig. 6A) is delicate and reticulate, with 2-9 papulae per papular area, but more commonly 5. The plates are irregular, ranging from bar to crescent shaped, the latter contributing to a scalloped appearance of the abactinal surface (Fig. 5A). Each plate is raised centrally into a low ridge, bearing 6-15 spaced, fine, serrate spinelets (0.26mm long, 0.04mm wide) (Fig. 6B).

The marginal plates (Fig. 6C) are distinct. The plates and their medial ridges are regular in shape and alignment forming a well developed horizontal series. The superomarginals are quadrilobed, higher than broad and each bears a central crescentic to trilobed ridge which carries 6-16 spinelets. The inferomarginals are quadrilobed, being markedly higher than broad. Spine-bearing medial ridges occur similarly to those on the superomarginals. The intermarginal plates are irregularly lobed, bearing vertical or crescentic, spine-bearing, medial ridges, the series extending $\frac{3}{5}R$ in the holotype, and in the paratype $\frac{2}{5}-\frac{1}{2}R$. The holotype has 2 series of intermarginal plates, the second extending to $\frac{1}{4}R$. The actinal plates are irregular and quadrilobed, with spined median ridges. The first actinal series extends for $\frac{3}{5}R$ and a second series, of a few plates in the holotype, and extending $\frac{1}{3}R$ in the paratype, lies above. The paratype also bears a series of a few plates between the second actinal series and the inferomarginal plates. Papulae are found throughout the marginal series (2-5 per papular area). Between the plates of the actinal series a single papula may be present. The spinelets on all marginal plates are similar to those of the abactinal plates, being irregularly toothed apically. The spinelets (12-18) are spaced on the ridge surface available (Fig. 6B).

Within the furrow there is a vertical series of 1-2 smooth tapered furrow spines in the holotype but only a single spine occurs in the paratype. The adambulacral plates (Fig. 6D) bear one long smooth subambulacral spine at the furrow edge. Behind these stand 10-13 subambulacral spines, decreasing in height with distance from furrow. The smallest spinelets are similar to those on the abactinal and marginal plates.

Each pair of oral plates (Figs 5B, 6E) is dominated by a large smooth recurved spine apically. In the paratype each plate also carries 3 spines along the furrow margin and 3 suboral spines on the actinal surface. Some of these spines have been lost in the paratype and completely lost from the holotype through mechanical damage. A small smooth spine is present distally on the lateral face of the oral plate.

Remarks: The variation seen between the holotype and paratype can be attributed to size differences. The crescentic plates abactinally give a scalloped effect not seen in other species of *Odontohenricia* here described. This, with the combined features of the trilobed ridges of the superomarginal and inferomarginal plates, the marked vertical alignment of the marginal series and oral plate armature distinguish this species.

The two specimens described herein were among 3 identified as *Henricia abyssalis* (Perrier), a species known to occur in South African waters (A. M. Clark and Courtman-Stock, 1976).

Distribution: At present known only from the type locality.

Etymology: Named for Ailsa Clark for her significant contribution to the knowledge of the echinoderm faunas, including that of southern Africa.

Description: The species has 5 rays, cylindrical and tapering to a rounded tip. Holotype $R=33\text{mm}$, $r=6.6\text{mm}$, $R/r=5$; paratype $R=26\text{mm}$, $r=4.4\text{mm}$, $R/r=5.9$. The disc is small. The madreporite occurs interradially at approximately $\frac{1}{3}r$.

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The marginal plates (Fig. 6C) are distinct. The plates and their medial ridges are regular in shape and alignment forming a well developed horizontal series. The superomarginals are quadrilobed, higher than broad and each bears a central crescentic to trilobed ridge which carries 6-16 spinelets. The inferomarginals are quadrilobed, being markedly higher than broad. Spine-bearing medial ridges occur similarly to those on the superomarginals. The intermarginal plates are irregularly lobed, bearing vertical or crescentic, spine-bearing, medial ridges, the series extending $\frac{3}{5}R$ in the holotype, and in the paratype $\frac{2}{5}-\frac{1}{2}R$. The holotype has 2 series of intermarginal plates, the second extending to $\frac{1}{4}R$. The actinal plates are irregular and quadrilobed, with spined median ridges. The first actinal series extends for $\frac{3}{5}R$ and a second series, of a few plates in the holotype, and extending $\frac{1}{3}R$ in the paratype, lies above. The paratype also bears a series of a few plates between the second actinal series and the inferomarginal plates. Papulae are found throughout the marginal series (2-5 per papular area). Between the plates of the actinal series a single papula may be present. The spinelets on all marginal plates are similar to those of the abactinal plates, being irregularly toothed apically. The spinelets (12-18) are spaced on the ridge surface available (Fig. 6B).

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Each pair of oral plates (Figs 5B, 6E) is dominated by a large smooth recurved spine apically. In the paratype each plate also carries 3 spines along the furrow margin and 3 suboral spines on the actinal surface. Some of these spines have been lost in the paratype and completely lost from the holotype through mechanical damage. A small smooth spine is present distally on the lateral face of the oral plate.

Remarks: The variation seen between the holotype and paratype can be attributed to size differences. The crescentic plates abactinally give a scalloped effect not seen in other species of *Odontohenricia* here described. This, with the combined features of the trilobed ridges of the superomarginal and inferomarginal plates, the marked vertical alignment of the marginal series and oral plate armature distinguish this species.

The two specimens described herein were among 3 identified as *Henricia abyssalis* (Perrier), a species known to occur in South African waters (A. M. Clark and Courtman-Stock, 1976).

Odontohenricia fisheri n.sp.

Figs 7A-B, 8A-E

Henricia leviuscula annectens; Fisher 1911, 291 (part) (non *H. leviuscula annectens* Fisher 1910).

Diagnosis: Rays 5, $R=82\text{mm}$, $r=15\text{mm}$, $R/r=5.5$, inflated proximally, tapering distally to narrow tip; abactinal skeleton open reticulate, plates ridged medially, 1-5 accessory plates sometimes present in papular areas, 1-7 papulae per area; abactinal spinelets 0.4mm long, 0.08mm wide, tapering to serrated tip, spinelets densely clustered; marginal plates distinct, quadrilobed, ridged medially, spinelets similar to those on abactinal plates; inferomarginals slightly higher than superomarginals; 4 rows of intermarginal plates, principal row extending for $\frac{1}{2}R$; 3 rows of actinal plates extending $\frac{4}{5}R$, $\frac{1}{5}R$ and $\frac{1}{10}R$ respectively; papulae extend to actinal series, with 1 per area; 2 furrow spines in vertical series; adambulacral plate with 3-5 smooth, cylindrical, sometimes spatulate subambulacral spines occurring on the adradial edge, behind which occur 9-11 cylindrical spines, apically serrate or smooth, in 2-3 more or less distinct rows, these subambulacral spines decrease in size across the plate; a large recurved spine occurs at the apex of the jaw, with 12-15 smaller, smooth suboral spines occurring on the adradial and actinal surfaces of the oral plates.

Material examined: One specimen, holotype, U.S. National Museum E3838, 48°33'N, 124°53'W, off Washington, U.S.A., 108m.

Distribution: At present known only from the type location.

Etymology: Named for Dr W. K. Fisher who has contributed much to our knowledge of the classification of sea-stars.

Description: Rays 5, long and cylindrical, inflated proximally and tapering to rounded tip (Fig. 7). $R=82\text{mm}$, $r=15\text{mm}$, $R/r=5.5$. The disc is relatively small. The madreporite, is ridged and spine-bearing, occurring interradially, at about $\frac{1}{2}r$.

The abactinal plates are irregularly bar to crescent shaped and form an irregular reticulum. Frequently (at least proximally) additional small plates are present within the papular areas (Fig. 8A). These areas may contain 1-7 papulae, but more commonly 3-4. The skeletal plates are raised medially forming low ridges. These ridges bear dense clusters of 3-24, but more commonly 15-20 tapered spinelets (length: 0.4mm, width 0.08mm) which are serrated apically (Fig. 8B).

The marginal series are distinct, the plates being aligned vertically and horizontally (Fig. 8C). The superomarginal plates are quadrilobed, higher than broad, each with an oblique crescentic ridge bearing a dense cluster of spinelets (24-28). The inferomarginal plates are quadrilobed, as high as wide, but larger than the superomarginals. Medial ridges of these plates are crescentic to ovoid in shape and carry dense clusters of spinelets (23-34).

The intermarginal plates are somewhat rectangular but may be enlarged basally or lobed laterally, and bear circular to ovoid medial ridges bearing spinelets. One intermarginal series extends approximately $\frac{1}{2}R$ although not clearly defined throughout. A second series between the first intermarginal and the inferomarginal series extends $\frac{1}{6}R$. In addition, a few plates occur between the superomarginal series and the principal intermarginal series, and also between the second intermarginal and inferomarginal series. The actinal plates are quadrilobed, as high as wide, each with an ovoid, medial, spinelet-bearing ridge (13-26 spinelets). The first series extends $\frac{4}{5}R$, a second

Odontohenricia fisheri n.sp.

Figs 7A-B, 8A-E

Henricia leviuscula annectens; Fisher 1911, 291 (part) (non *H. leviuscula annectens* Fisher 1910).

Diagnosis: Rays 5, $R=82\text{mm}$, $r=15\text{mm}$, $R/r=5.5$, inflated proximally, tapering distally to narrow tip; abactinal skeleton open reticulate, plates ridged medially, 1-5 accessory plates sometimes present in papular areas, 1-7 papulae per area; abactinal spinelets 0.4mm long, 0.08mm wide, tapering to serrated tip, spinelets densely clustered; marginal plates distinct, quadrilobed, ridged medially, spinelets similar to those on abactinal plates; inferomarginals slightly higher than superomarginals; 4 rows of intermarginal plates, principal row extending for $\frac{1}{2}R$; 3 rows of actinal plates extending $\frac{4}{5}R$, $\frac{1}{5}R$ and $\frac{1}{10}R$ respectively; papulae extend to actinal series, with 1 per area; 2 furrow spines in vertical series; adambulacral plate with 3-5 smooth, cylindrical, sometimes spatulate subambulacral spines occurring on the adradial edge, behind which occur 9-11 cylindrical spines, apically serrate or smooth, in 2-3 more or less distinct rows, these subambulacral spines decrease in size across the plate; a large recurved spine occurs at the apex of the jaw, with 12-15 smaller, smooth suboral spines occurring on the adradial and actinal surfaces of the oral plates.

Material examined: One specimen, holotype, U.S. National Museum E3838, 48°33'N, 124°53'W, off Washington, U.S.A., 108m.

Distribution: At present known only from the type location.

Etymology: Named for Dr W. K. Fisher who has contributed much to our knowledge of the classification of sea-stars.

Description: Rays 5, long and cylindrical, inflated proximally and tapering to rounded tip (Fig. 7). $R=82\text{mm}$, $r=15\text{mm}$, $R/r=5.5$. The disc is relatively small. The madreporite, is ridged and spine-bearing, occurring interradially, at about $\frac{1}{2}r$.

The abactinal plates are irregularly bar to crescent shaped and form an irregular reticulum. Frequently (at least proximally) additional small plates are present within the papular areas (Fig. 8A). These areas may contain 1-7 papulae, but more commonly 3-4. The skeletal plates are raised medially forming low ridges. These ridges bear dense clusters of 3-24, but more commonly 15-20 tapered spinelets (length: 0.4mm, width 0.08mm) which are serrated apically (Fig. 8B).

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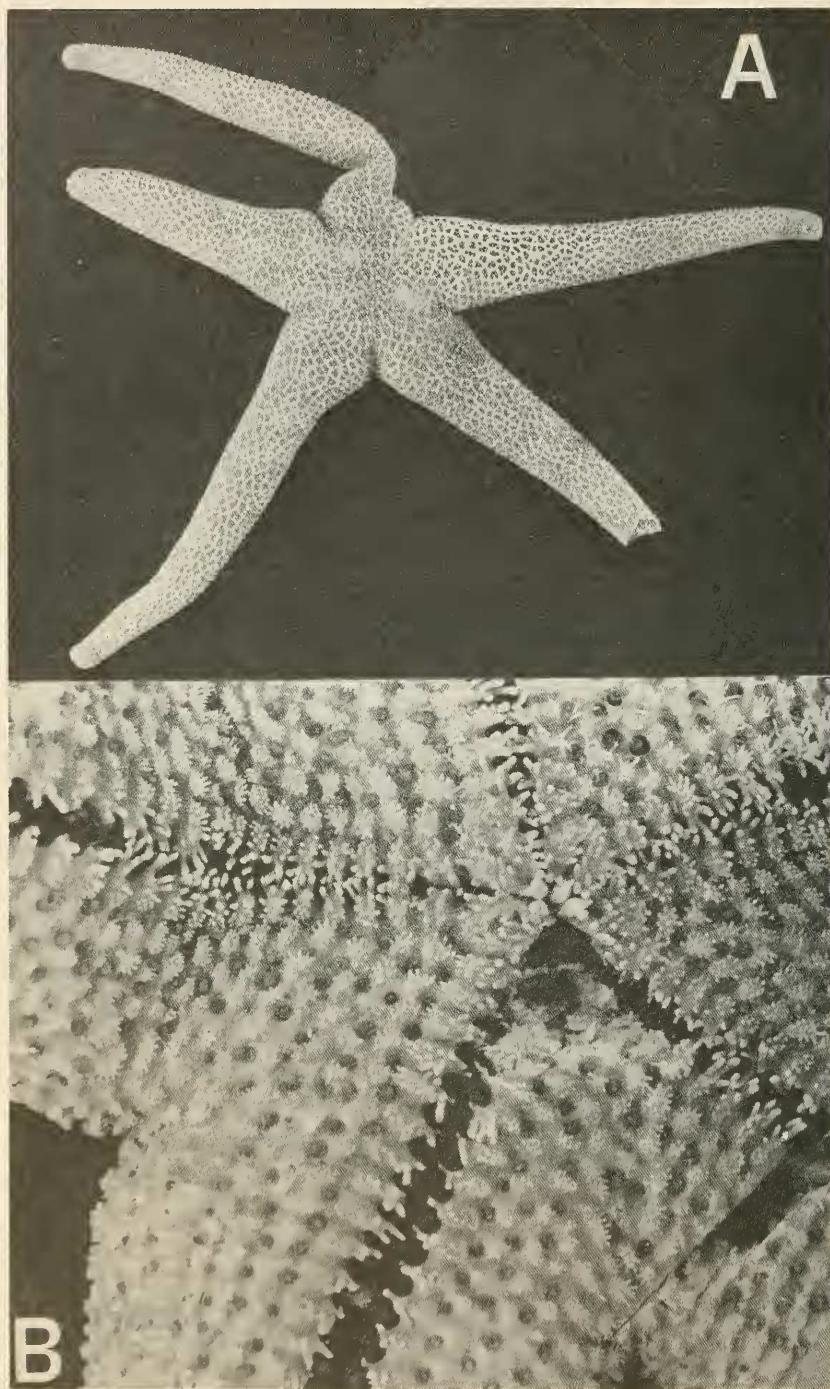


Fig. 7. *Odontohenricia fisheri* n. gen. et sp. (holotype; U.S. National Museum E3838): A. abactinal surface; B. actinal surface, showing apical oral spines, actinal papulae and adambulacral and actinal spinature ($R=82\text{mm}$).

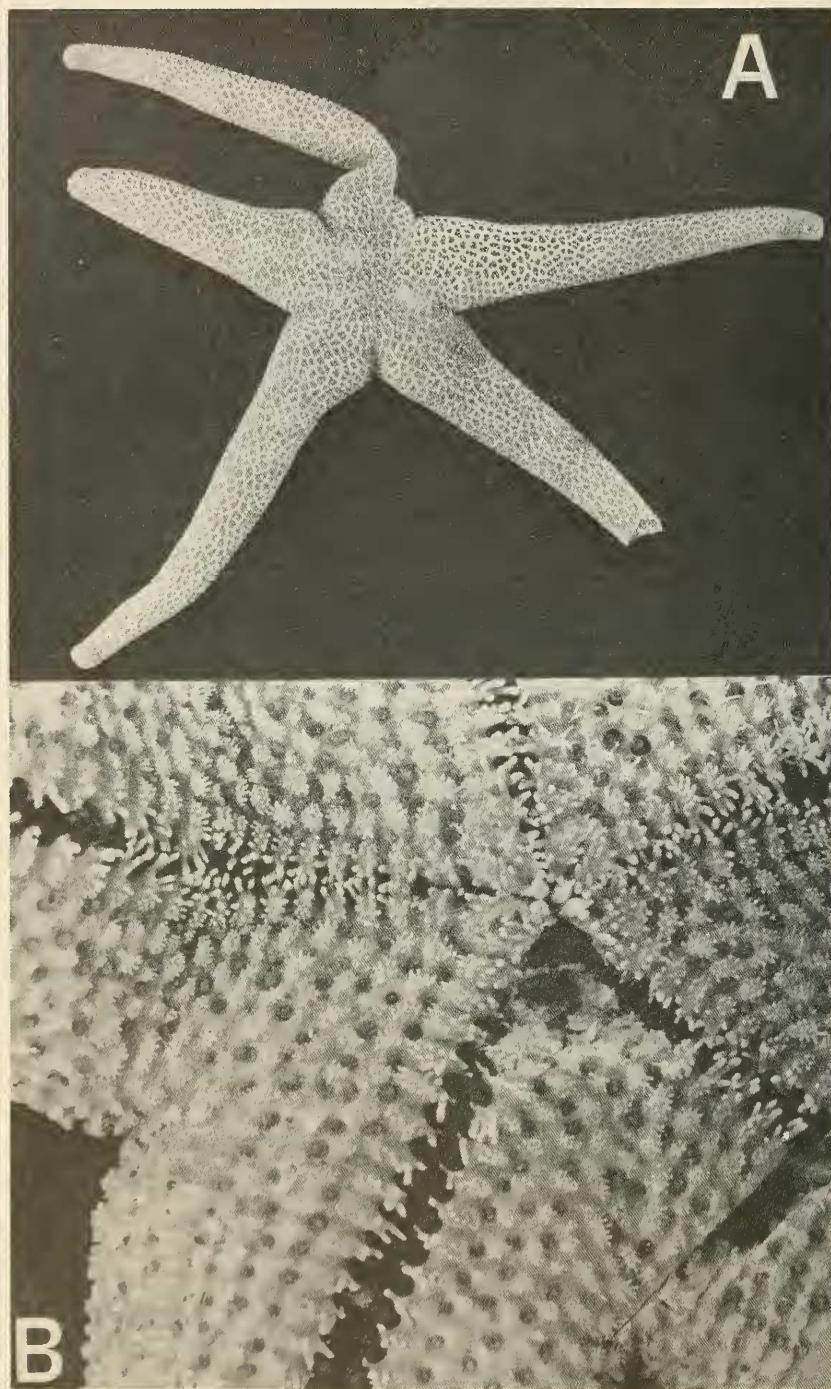


Fig. 7. *Odontohenricia fisheri* n. gen. et sp. (holotype; U.S. National Museum E3838): A. abactinal surface; B. actinal surface, showing apical oral spines, actinal papulae and adambulacral and actinal spinature ($R=82\text{mm}$).

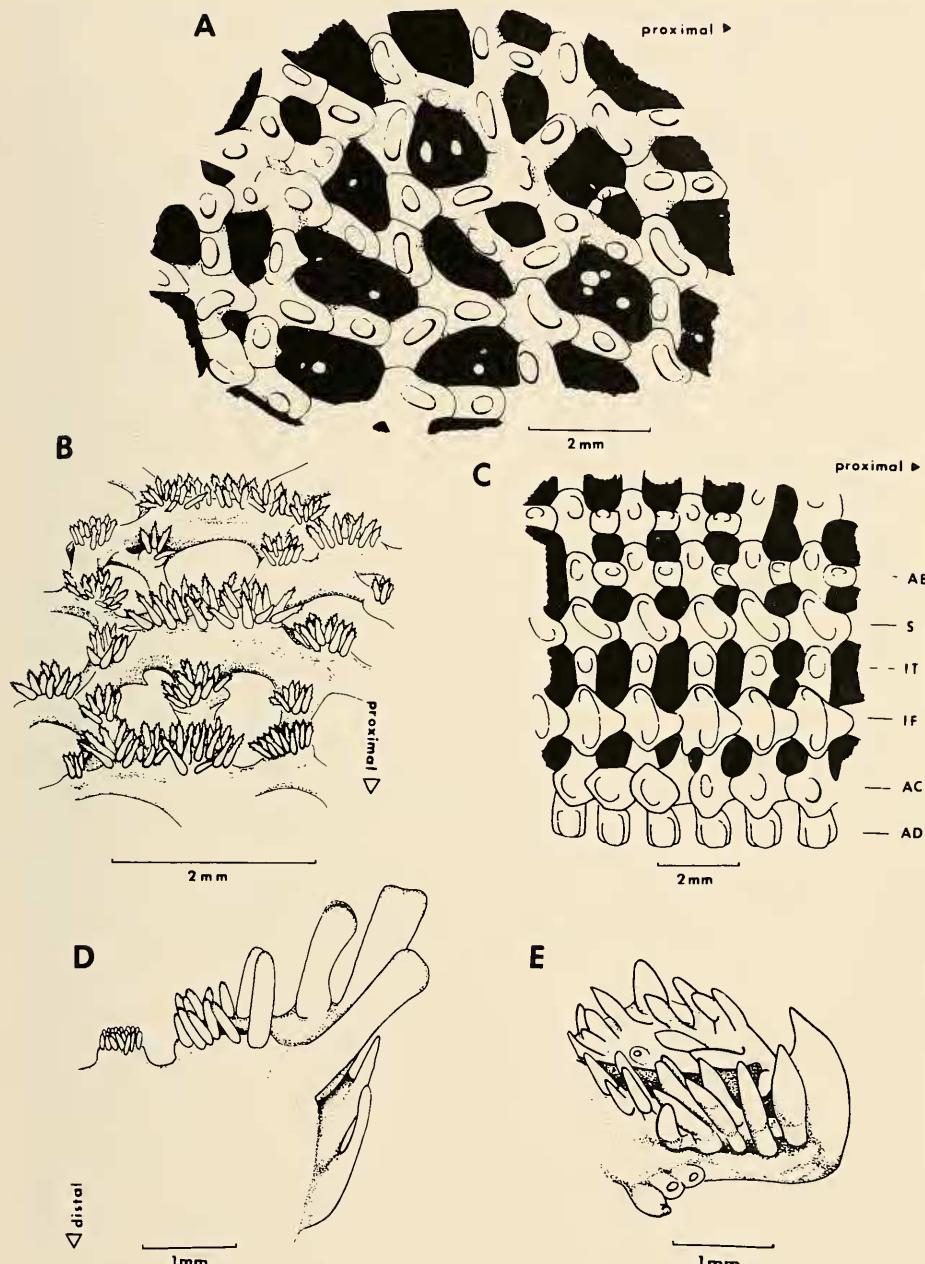


Fig. 8. *Odontohenricia fisheri* n. gen. et. sp. (holotype; U.S. National Museum E3838): A. denuded abactinal skeleton of arm (proximal); B. abactinal spinelets of arm (proximal); C. denuded skeleton of arm, lateral view from 11th to 16th superomarginal plate; AB = abactinal plates, S = superomarginal plates, IT = intermarginal plates, IF = inferomarginal plates, AC = actinal plates, AD = adambulacrinal plate; D. profile view of 9th adambulacrinal plate showing furrow and subambulacrinal spines and with adjacent actinal plate and spinelets; E. oblique-lateral view of oral plate pair with large apical and suboral spines.

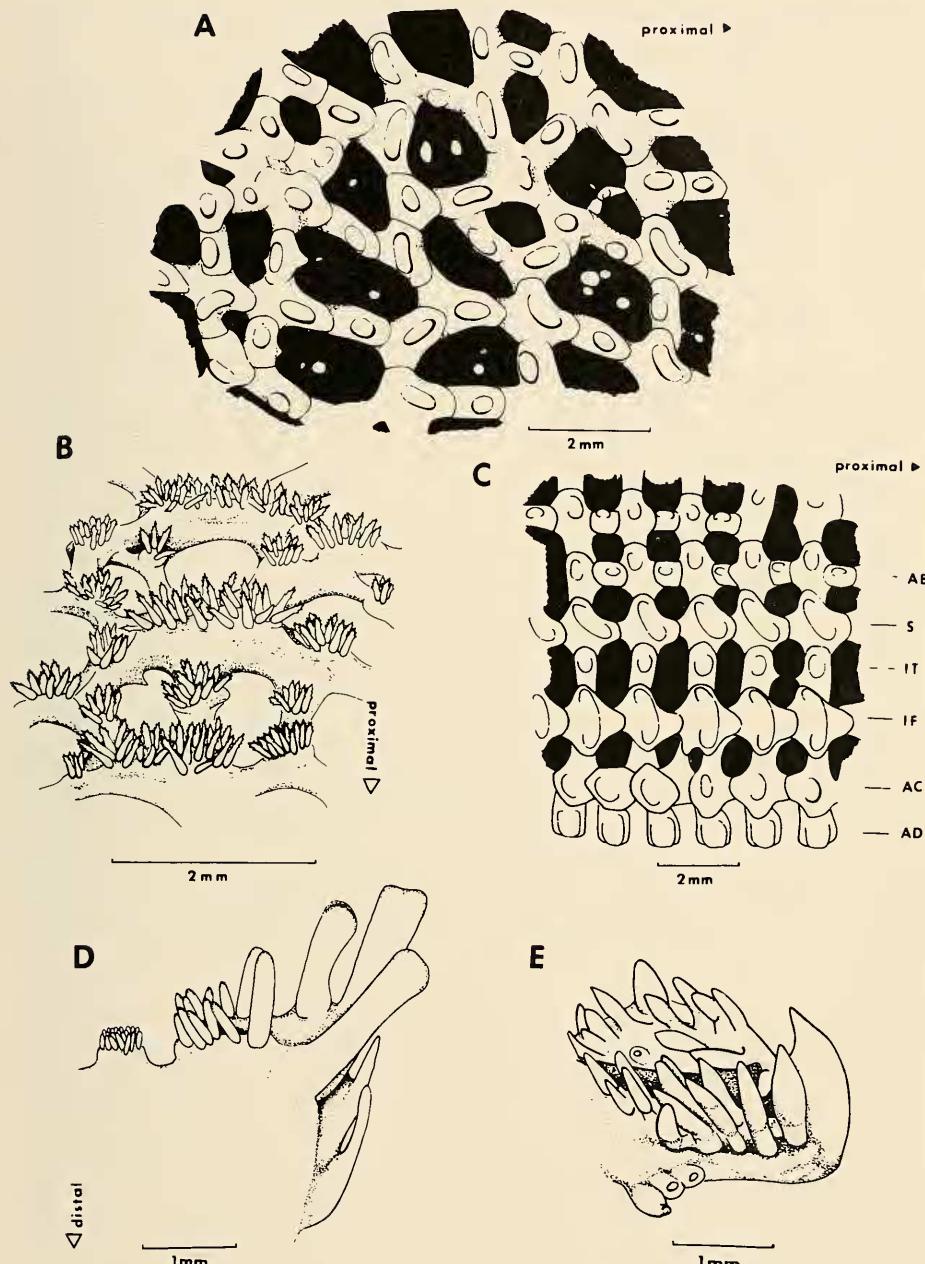


Fig. 8. *Odontohenricia fisheri* n. gen. et. sp. (holotype; U.S. National Museum E3838): A. denuded abactinal skeleton of arm (proximal); B. abactinal spinelets of arm (proximal); C. denuded skeleton of arm, lateral view from 11th to 16th superomarginal plate; AB = abactinal plates, S = superomarginal plates, IT = intermarginal plates, IF = inferomarginal plates, AC = actinal plates, AD = adambulacrinal plate; D. profile view of 9th adambulacrinal plate showing furrow and subambulacrinal spines and with adjacent actinal plate and spinelets; E. oblique-lateral view of oral plate pair with large apical and suboral spines.

series to $1/5R$, and a third to $1/10R$. The spinelets occurring on the marginal plates are similar to those found abactinally. Papulae extend throughout the marginal series with one papula between actinal and inferomarginal plates and elsewhere 1-5 per papular area.

There are 2 spines in vertical series within the furrow. The adambulacral plates bear 3-5 smooth, elongate and sometimes spatulate spines. Behind these are 9-11 cylindrical spines which may be serrated apically or smooth. These form 2-3 more or less distinct rows, although they may also be clustered (Fig. 8D).

Each pair of oral plates bears a large, smooth, recurved, hyaline spine apically (Fig. 8E). Each oral plate also bears 5-6 small cylindrical spines along the furrow margin, with an irregular row of 4-6 subambulacral spines on the actinal surface of the plate. In addition there are 3-5 subambulacral spines distally.

Remarks: *Odontohenricia fisheri* is clearly distinguishable from other species of *Odontohenricia* by its size, the presence of additional plates within the abactinal reticulum, the rectangular intermarginal plates and the abundance of oral plate spines and other skeletal plate spines. Fisher (1911) identified this specimen as *Henricia leviuscula annectens*.

Odontohenricia hayashii n.sp.

Figs 9A-B, 10A-F

Diagnosis: Rays 5, $R=35\text{mm}$, $r=6\text{mm}$, $R/r=5.9\text{mm}$; slender, tapering to rounded tip; abactinal skeleton reticulate, 1-5 papulae per area; abactinal spinelets, 0.48mm long, 0.08mm wide, slender and apically dentate, 1-9 spinelets per plate in tufts or irregular rows; marginal plates prominent, superomarginal, inferomarginal and actinal series being similar in shape size and alignment, all with oblique medial ridges bearing spinelets; intermarginal plates irregular, lobed, frequently fused, in 3 series, first row to $\frac{1}{4}R$ and the second and third comprising a few plates only, 2 actinal series to $\frac{3}{4}R$ and $\frac{1}{5}R$ respectively, papulae present between marginals and actinals, 1-4 per papular area; plates show widespread extensions which restrict the papular area, marginal spinelets as for abactinal plates; 1(2) furrow spines, adambulacral plates with a single prominent subambulacral spine on adradial edge, and with 8-10 cylindrical subambulacral spines in, more or less, 2 rows, decreasing in size across the adambulacral plate; oral plates with recurved, hyaline, apical spine, additional 7(8) regular suboral spines on each plate.

Material examined: one specimen, holotype, U.S. National Museum E34052, Sagami Bay, Honshu, $35^{\circ}50'N$, $139^{\circ}35'E$, Japan, 152-289m.

Distribution: at present known only from type locality.

Etymology: named for Dr Ryoji Hayashi, who has contributed much to our knowledge of the Japanese sea-stars.

Description: Rays 5, cylindrical and slender, tapering to a rounded tip (Fig. 9). $R=35\text{mm}$, $r=6\text{mm}$, $R/r=5.9\text{mm}$. The disc is relatively small. The madreporite occurs interradially, $\frac{1}{2}R$.

The abactinal plates are tapered, bar and quadrilobed in shape, overlapping to form a fine, open, more or less regular reticulate skeleton (Figs 10A, B). The plates are raised medially and bear 1-9 but more usually 5-7 spinelets in tufts or irregular rows.

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Odontohenricia hayashii n.sp.

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Material examined: one specimen, holotype, U.S. National Museum E34052, Sagami Bay, Honshu, $35^{\circ}50'N$, $139^{\circ}35'E$, Japan, 152-289m.

Distribution: at present known only from type locality.

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Description: Rays 5, cylindrical and slender, tapering to a rounded tip (Fig. 9). $R=35\text{mm}$, $r=6\text{mm}$, $R/r=5.9\text{mm}$. The disc is relatively small. The madreporite occurs interradially, $\frac{1}{2}R$.

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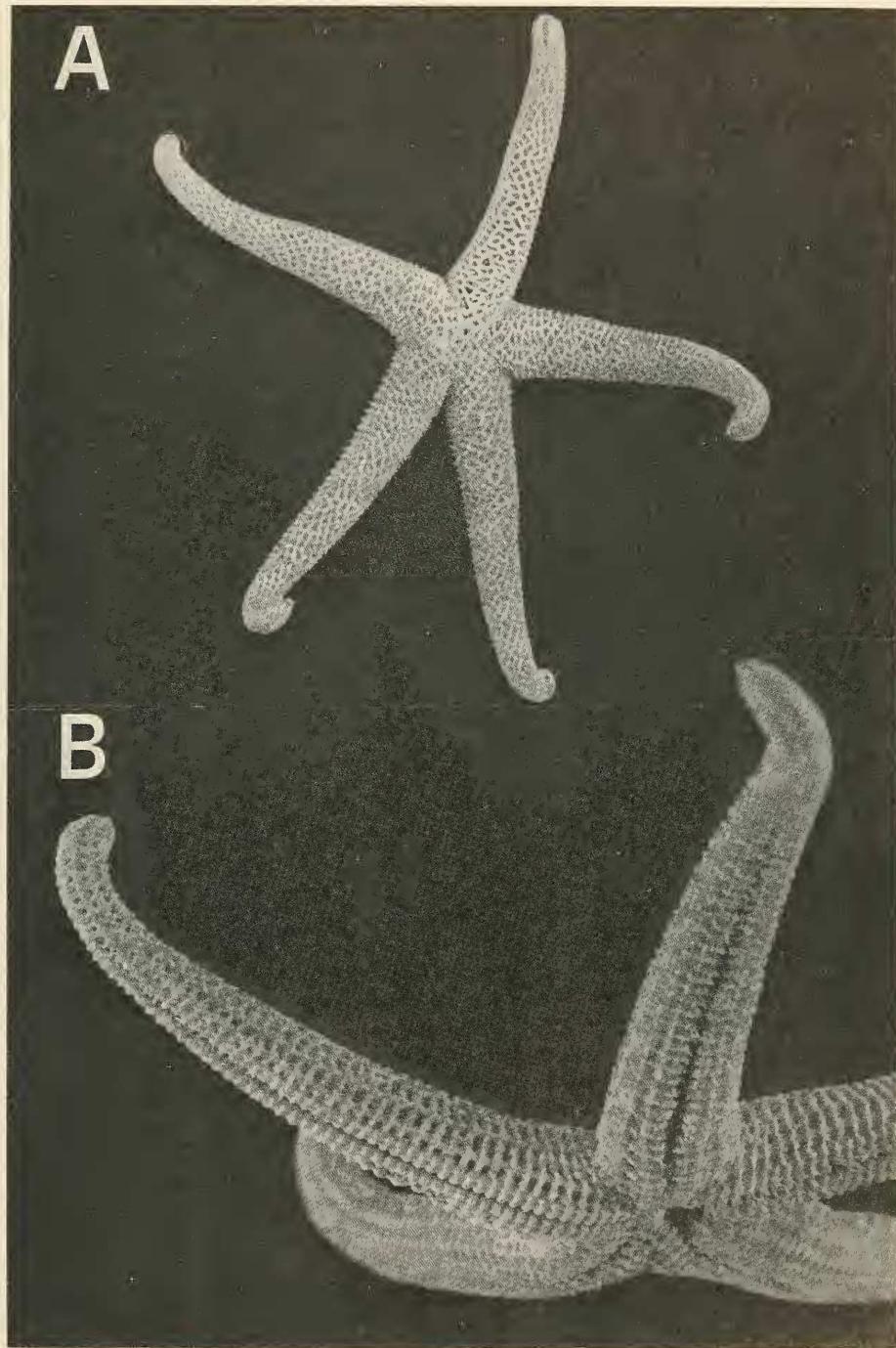


Fig. 9. *Odontohenricia hayashii* n. gen. et. sp. (holotype; U.S. National Museum 38307): A. abactinal surface; B. lateral view of arm ($R = 35\text{mm}$).

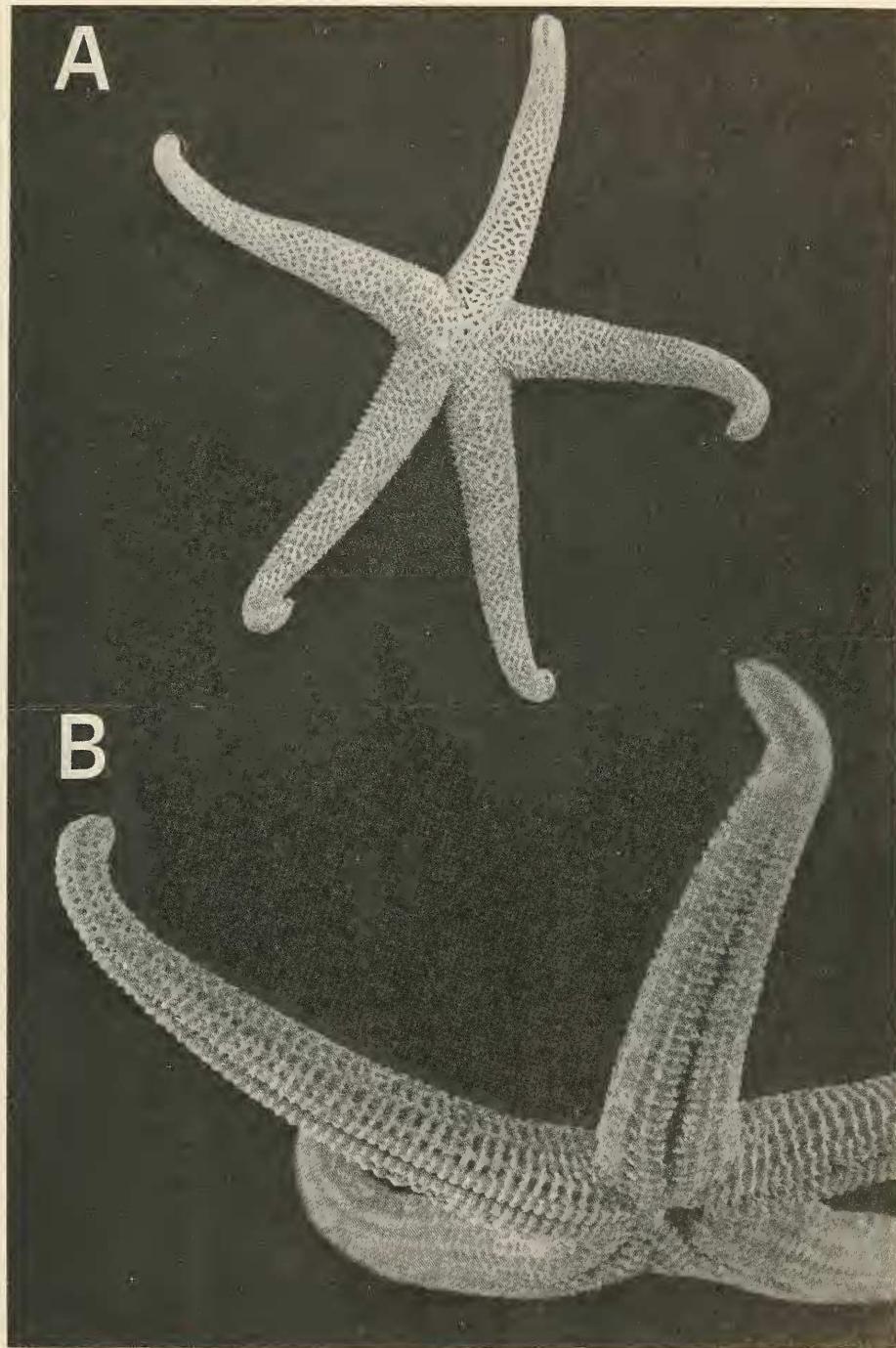


Fig. 9. *Odontohenricia hayashii* n. gen. et. sp. (holotype; U.S. National Museum 38307): A. abactinal surface; B. lateral view of arm ($R = 35\text{mm}$).

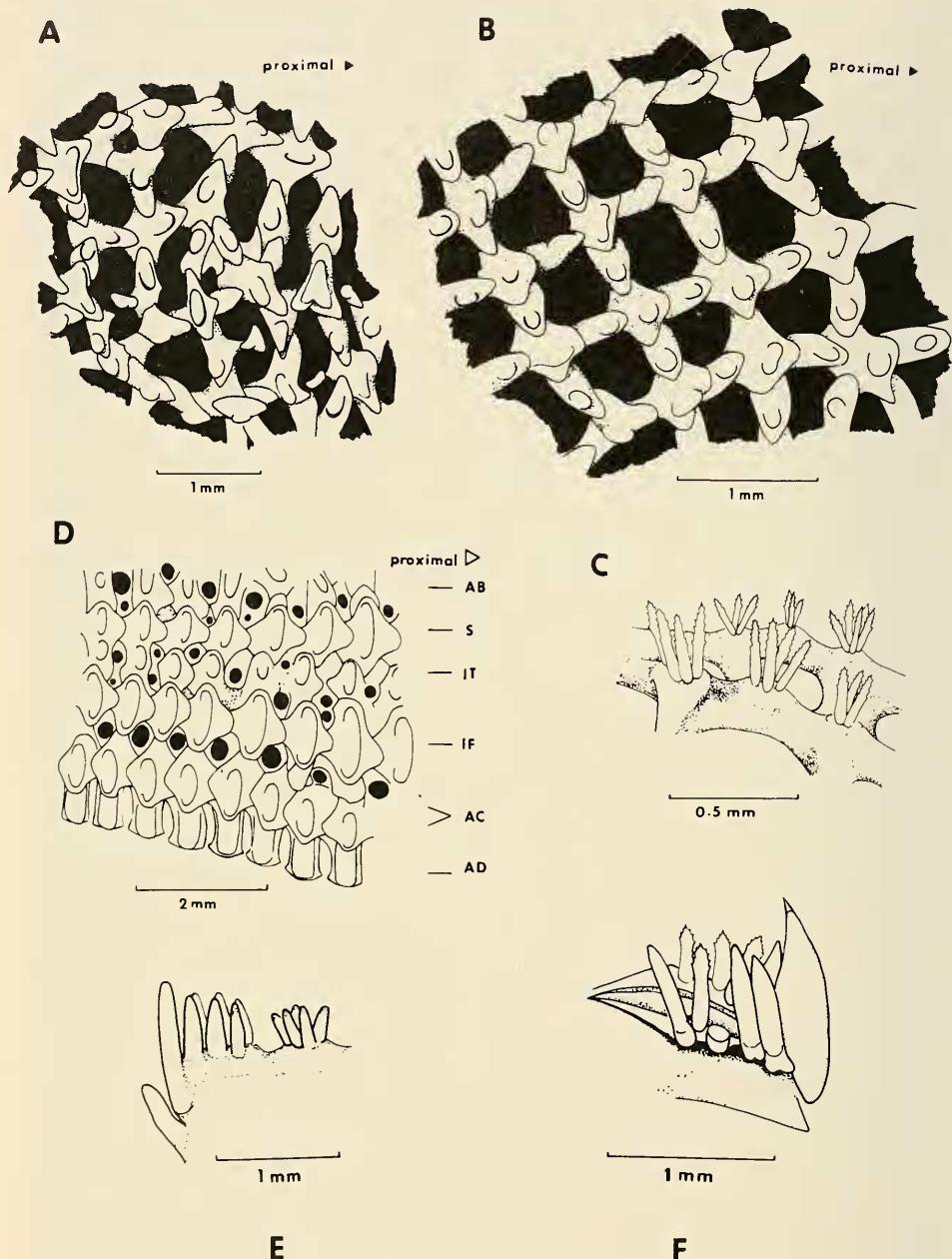


Fig. 10. *Odontohenricia hayashii* n. gen. et sp. (holotype; U.S. National Museum 38307): A. denuded abactinal skeleton of arm (proximal); B. denuded abactinal skeleton of arm (distal); C. abactinal spinelets of arm (proximal); D. denuded skeleton of arm, lateral view from 7th to 13th superom marginal plate; AB = abactinal plates, S = superom marginal plates, IT = intermarginal plates, IF = inferomarginal plates, AC = actinal plates, AD = adambulacr al plate; E. profile view of adambulacr al plate showing furrow and subambulacr al spines and with adjacent actinal plate (composite drawing from 13th and 14th plates due to damage); F. oblique-lateral view of oral plate pair with large apical spine and suboral spines.

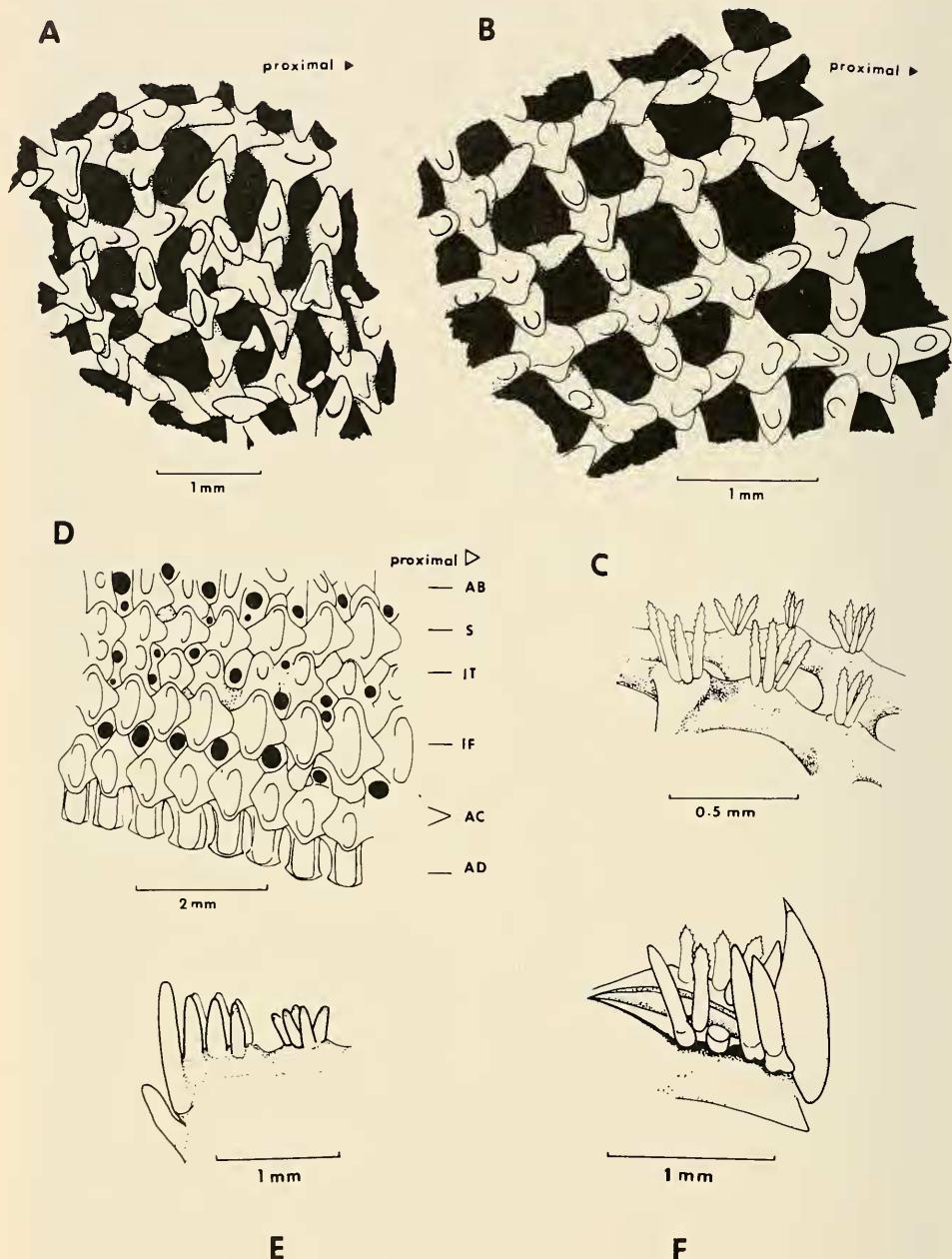


Fig. 10. *Odontohenricia hayashii* n. gen. et sp. (holotype; U.S. National Museum 38307): A. denuded abactinal skeleton of arm (proximal); B. denuded abactinal skeleton of arm (distal); C. abactinal spinelets of arm (proximal); D. denuded skeleton of arm, lateral view from 7th to 13th superom marginal plate; AB = abactinal plates, S = superom marginal plates, IT = intermarginal plates, IF = inferomarginal plates, AC = actinal plates, AD = adambulacr al plate; E. profile view of adambulacr al plate showing furrow and subambulacr al spines and with adjacent actinal plate (composite drawing from 13th and 14th plates due to damage); F. oblique-lateral view of oral plate pair with large apical spine and suboral spines.

The spinelets are 0.48mm long, 0.08mm wide and dentate apically. The papular areas are small, bearing 1-5 but more commonly 2-3 papulae per area.

The superomarginal, inferomarginal and actinal plates are distinct, being of comparable shape and size, and regularly aligned (Fig. 10D). They are quadrilobed, as high as wide, and bear a transverse, medial, spinelet bearing ridge. The intermarginal plates are irregularly lobed and frequently fused. There is one principal series, extending $\frac{1}{2}R$, and 2 additional series of only a few plates, one above and one below the principal series. These plates are also spined and ridged medially, and are aligned with those of the other marginal series. There are 2 actinal series of plates, the first extending $\frac{3}{4}R$ and a second extending $\frac{1}{5}R$. Papulae are present between these marginal series, usually 1 per papula area, rarely 2. There is extensive broadening of plates throughout the marginal series, excluding spaces for papulae. The spinelets found on the marginal plate ridges are as those of abactinal plates. Within the furrow there is one, sometimes 2 cylindrical spines in vertical series. There is a single prominent, cylindrical subambulacral spine on the adradial edge of the adambulacral plate, behind which are 8-10 cylindrical, round-tipped subambulacral spines in 2 more or less regular rows (Fig. 10E). These spines decrease in height and breadth with distance from the furrow. The oral plate pair is dominated by a large smooth recurved apical spine. Four regular spines are also found along the furrow margin of the oral plate, with 1-2 additional suboral spines (Fig. 10F).

Remarks: This species is clearly distinguished from other *Odontohenricia* here described by the small clusters of long abactinal spinelets, and the extension to the marginal plates. A. H. Clark identified 2 specimens from 'Albatross' station 3749 as *Henricia densispina* (Sladen) one of which we describe here as the holotype of *O. hayashii*. The identity of the second specimen may also be questionable though *H. densispina* has been recorded from Japanese waters by Hayashi (1940).

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